

REMARKS

Claims 1-56, and 58-61 were pending in the present application. Claims 1, 4-5, 14, 17, 22-23, 30, 35-36, 42, 53, 56, and 58 have been amended. Claims 13, 39-41, 57, and 60 have been canceled. As a result of this amendment, claims 1-12, 14-38, 42-56, and 58-59, and 61 are pending. Reexamination and reconsideration are requested in light of the accompanying amendments and remarks.

Applicant gratefully acknowledges the withdrawal of the election requirement.

The rejection of claims 14, 30, and 35 under 35 U.S.C. § 112, second paragraph as being indefinite is respectfully traversed. The term “amide/imidazoline” is known to those skilled in the art, as demonstrated by its use in a number of other patents, including U.S. Patent Nos. 6,212,756, 5,767,047, 5,681,800, and 5,658,863. Applicant respectfully requests that the rejection be withdrawn.

The specification and claims 14, 30, and 35 have been amended to recite that suitable amides can be modified or unmodified amide/imidazoline. Support for these amendments can be found at p. 3, lines 27-29, p. 6, lines 23-31, and claims 14, 30, and 35.

The rejection of claims 1-10, 13-18, 21-23, 26-32, 36, 37, 40-42, 45-49, 52, 55, and 58-61 under 35 U.S.C. § 102(b) as being anticipated by Walker (U.S. Patent No. 5,688,905) has been overcome.

Walker teaches an amine hardener composition for curing epoxy resin based coatings and related products comprising from 5 to 75% of a diamine which possesses a vapor pressure less than about 133 Pascals at 20°C, contains both a primary and a tertiary amine and corresponds to two specific structures, from 0 to 95% of a polyamide, amidoamine, Mannich base, or cycloaliphatic amine curing agent, and from 0 to 50% of other active hydrogen containing diamines or polyamines.

Walker does not teach that its composition “has a mixed viscosity of less than 150 cps” as in claims 1 and 17. Support for this amendment can be found at p. 4, lines 8-12. The mixed viscosity of Walker’s systems is in excess of 500 cP. See Tables 1 and 2. Low viscosity provides superior wicking and penetration properties, which are important for the high strength infiltrant system. See p. 4, lines 8-12 and 19-30; p. 5, lines 1-12; p.

6, lines 6-18 and 23-31; and p. 7, lines 6-11.

Thus, Walker does not anticipate claims 1 or 17 or the claims dependent on them.

In addition, Walker does not teach the use of a combination of a difunctional reactive diluent and a monofunctional reactive diluent having the claimed amounts as in claims 36 and 58. Walker teaches the use of only a monofunctional diluent. Walker does not teach the use of any difunctional diluent, nor does it teach the use of any specific amount of monofunctional diluent.

Diluents can adversely affect the properties of the cured and uncured material. Monofunctional diluents have a larger adverse effect on physical properties than difunctional diluents because they terminate the polymerization process. Difunctional diluents minimize the adverse effects of having large amounts of diluents in the system because they do not terminate the polymerization reaction due to the difunctional reactivity. Therefore, it is desirable to keep the use of monofunctional diluents as low as possible to minimize negative effects. See p. 5, lines 1-12. As a result the use of a combination of difunctional and monofunctional diluent and the amounts of each are important considerations.

Therefore, Walker does not anticipate claims 36 or 58 or the claims dependent on them.

With respect to claims 4-6, Walker does not teach the use of a combination of difunctional reactive diluents and monofunctional reactive diluents, as discussed above. Nor does Walker teach the use of diglycidyl ether or neopentyl glycol diglycidyl ether.

With respect to claim 17, as discussed above, Walker does not teach the claimed mixed viscosity, as discussed above.

In addition, Walker does not teach the claimed amount of epoxy resin. Walker does not teach any specific amount of epoxy resin in col. 5, line 60 through col. 7, line 12.

Nor does Walker teach the claimed amount of diluent. Walker does not teach the use of any specific amount of diluent in col. 7, lines 13-48.

Although the amine hardeners of this invention allow the formulation of very high or even 100% solids systems without the need to incorporate

monofunctional epoxy diluents, the resin may be modified with a portion of monofunctional epoxide. In this way viscosity is further reduced, which may be advantageous in certain cases, such as for example to increase the level of pigment in a formulation while still allowing easy application, or to allow the use of a higher molecular weight epoxy resin. Examples of useful monoepoxides include styrene oxide, cyclohexene oxide, ethylene oxide, propylene oxide, butylene oxide, and the glycidyl ethers of phenol, the cresols, tert-butylphenol and other alkyl phenols, butanol, 2-ethylhexanol and the like.

Normally, coating compositions according to the present invention will consist of at least two components, one of which contains the epoxy resin, and the other the hardener, or curing agent. It will sometimes be advantageous to include one or more organic solvents in one or both components of the coating. The solvents are employed to, for example, reduce the viscosity of the individual or combined components, to reduce the surface tension of the formulation, to aid in film formation, and to increase pot life. Useful solvents are the lower molecular weight glycol ethers such as ethylene glycol monopropyl ether, ethylene glycol monobutyl ether, ethylene glycol monoethyl ether, propylene glycol monomethyl ether, propylene glycol monoethyl ether, diethylene glycol monobutyl ether, and the like, the aromatic solvents such as toluene and xylene and aromatic solvent blends such as Aromatic 100 solvent, ketones such as methyl ethyl ketone, methyl isobutyl ketone, and methyl amyl ketone, esters such as butyl acetate, and alcohols such as isopropyl alcohol, butanol, and 2-ethylhexanol. If ester solvents are employed, they should normally be incorporated in the epoxy side of the formulation to prevent reaction with the curing agent during storage.

Clearly, no specific amount of diluent is given.

With respect to claims 22-23, and 26, Walker does not teach the use of a combination of difunctional reactive diluents and monofunctional reactive diluents, as discussed above. Nor does Walker teach the use of diglycidyl ether or neopentyl glycol diglycidyl ether.

With respect to claim 36, Walker does not teach the use of a combination of difunctional reactive diluents and monofunctional reactive diluents, as discussed above.

In addition, Walker does not teach the claimed amount of difunctional reactive diluent and monofunctional reactive diluent. Furthermore, Walker does not teach the claimed amount of epoxy resin.

With respect to claims 42 and 45, Walker does not teach the use of diglycidyl ether, or neopentyl glycol diglycidyl ether.

As to claim 58, Walker does not teach the use of a combination of difunctional reactive diluents and monofunctional reactive diluents, as discussed above. In addition, Walker does not teach the claimed amount of difunctional reactive diluent and monofunctional reactive diluent.

Therefore, claims 1-10, 13-18, 21-23, 26-32, 36, 37, 40-42, 45-49, 52, 55, and 58-61 are not anticipated by Walker.

The rejection of claim 33 under 35 U.S.C. § 103(a) as being unpatentable over Walker has been overcome. Claim 33 is dependent on claim 17. As discussed above, Walker does not teach or suggest the use of the claimed mixed viscosity, as discussed above. In addition, Walker does not teach or suggest the claimed amount of epoxy resin. Nor does Walker teach or suggest the claimed amount of diluent. Therefore, claim 33 would not have been obvious to one having ordinary skill in the art at the time the invention was made over Walker.

The rejection of claims 6, 19, 20, 24-26, 38, 39, and 43-45 under 35 U.S.C. § 103(a) as being unpatentable over Walker in view of Alvino has been overcome. Alvino is cited as teaching the use of diglycidyl ethers of neopentyl glycol.

According to the examiner, "Alvino et al. disclose a similar epoxy resin composition (see Abstract; col. 2, lines 26-60). However, contrary to the examiner's position, Alvino does not disclose a similar epoxy resin composition. Alvino is a B-staged epoxy composition, which is a one-component composition. In a B-staged epoxy composition, reactive components Part A and Part B are already mixed and may be partially polymerized. However, they need heat or other means to complete the cure. Woven glass fiber is immersed in the one-component epoxy resin, which is then heated to remove solvent and to cause a partial cure of the resin. The glass fiber with the B-staged epoxy resin would then be further processed at a later time to finally cure the resin.

Referring now to FIG. 1 of the drawings, there is illustrated a treater 10 comprising a tank 11 containing a modified dicyandiamide epoxy resin impregnant solution 12 and an oven 13. *Woven glass fabric 14 is taken off of the pay-off reel 15 and passed into the resin tank 11 where it is held immersed in the impregnant 12 by the roll 16.* Emerging from the tank, the fabric passes between the rolls 17 and 18 which remove excess resin solution, to provide a resin content of at least about 35% by weight based on the total dry weight of the fabric. *The impregnated fabric is then directed into the oven 13. In the oven, it is heated to remove solvent and cause the resin to partially cure to a non-tacky but fusible stage which is dry to the touch, and capable of flow and final curing upon application of heat, herein defined as the "B-stage".* During heating, usually at a temperature of between about 110°C. and about 150°C., the solvent present in the resin solution is evaporated, to provide a resin content in the fabric of between 25% and 60% by weight based on the total dry weight of the fabric.

The heating is conducted so that the resulting impregnated material has a "greenness" of from about 0.5% to about 15%. The greenness is determined by placing several pieces of the resin treated sheet material in a hot press at a temperature of 175.degree. C. and a pressure of 1,000 pounds per square inch for 5 minutes, and then measuring the amount of resin that is forced out of the sample, that is, the resin that extends beyond the fibrous sheet material proper, and determining the proportion of this exuded resin to all of the resin in the sample. After cooling, the B-stage resin impregnated material or prepreg is wound onto the take-up reel 19.

Col. 3, line 64 to col. 4, line 27. Such one component B-stage resin compositions are not similar to the claimed two component resin systems. One component systems have a limited range of physical properties that they can deliver. Due to the limitation of available curing agents for that type of curing mechanism, the cured polymer is usually a very rigid one with no or very little flexibility, low impact resistance, poor adhesion, limited shelf life, and high viscosity. One of skill in the art looking for either a high strength infiltrant system or a flexible infiltrant system would not consider one component epoxy systems because of their high viscosity, lack of physical properties

needed, and powdered curing agent.. The curing agent(s) is in powder form so that during the wicking process, the solid curing agent could be filtrated out and epoxy absorbed deep in the printed part might never cure due to absence of curing agent.

Even assuming that Alvino can be combined with Walker, Alvino does not cure the deficiencies of Walker.

With respect to claims 6, and 26, neither Walker nor Alvino teach or suggest the use of the claimed mixed viscosity, as discussed above. In addition, neither Walker nor Alvino teach or suggest the use of a combination of difunctional and monofunctional reactive diluents. As discussed above the combination of difunctional and monofunctional reactive diluents and the specified amounts help to provide an infiltrant system having the desired properties.

As to claim 45, Walker and Alvino do not teach or suggest the use of a combination of difunctional and monofunctional reactive diluents, nor do they teach or suggest the use of the claimed amounts of difunctional and monofunctional reactive diluents.

As to claims 24 and 25, neither Walker nor Alvino teach or suggest the use of the claimed mixed viscosity. In addition, neither Walker nor Alvino teach or suggest the use of a combination of difunctional and monofunctional reactive diluents, nor do they teach or suggest the use of the claimed amounts of difunctional and monofunctional reactive diluents.

The examiner cited col. 4, lines 51-65 as teaching the amounts of difunctional and monofunctional reactive diluent. However, Alvino simply teaches the use of diluent in an amount up to about 26% of the resin. Alvino does not teach the use of a combination of difunctional and monofunctional reactive diluents. Nor does it teach or suggest the use of the specified amounts of the difunctional and monofunctional reactive diluents.

Effective amounts of epoxy diluents, such as the diglycidyl ether of a glycol having from 2 to 12 carbon atoms in the glycol unit, for example, the diglycidyl ether of neopentyl glycol; as well as 1,4-butanediol diglycidyl ether; butyl glycidyl ether; bis (2,3-epoxy-2-methyl propyl) ether; 1,2-epoxy-3-phenoxy propane and the like, can be used to provide high solids, low viscosity impregnating solutions. These epoxy diluents, having a low viscosity, i.e.,

between about 5 cps. and about 200 cps. at 25°C., can act as a co-solvent to some extent for the dicyandiamide derivative, cutting down on the amount of solvent required for their dissolution. *The useful weight ratio of epoxy resin:epoxy diluent is from about 1:0 to 0.35, i.e., up to about 35 parts of diluent can be used per 100 parts of epoxy resin.*

As to claims 43 and 44, Alvino does not teach or suggest the use of a combination of difunctional and monofunctional reactive diluents, nor does it teach the specified amounts, as discussed above.

As to claims 19-20, Walker and Alvino do not teach or suggest the claimed mixed viscosity. As to claims 19-20, and 38 (claim 39 having been canceled), Walker and Alvino do not teach or suggest the claimed combination of difunctional and monofunctional reactive diluents, nor do they teach or suggest the claimed amounts of difunctional and monofunctional reactive diluents.

Therefore, claims 6, 19, 20, 24-26, 38, 39, and 43-45 would not have been obvious to one having ordinary skill in the art at the time the invention was made over Walker in view of Alvino.

The rejection of claims 11, 12, 50, 51, and 56 under 35 U.S.C. § 103(a) as being unpatentable over Walker in view of Chow has been overcome. Chow is cited as teaching the use of di- γ -aminopropyl ether of diethylene glycol and propylene glycol diamines as polyamine hardeners.

However, Chow fails to remedy the deficiencies of Walker. As discussed above, Walker does not teach or suggest the use of a combination of difunctional and monofunctional reactive diluents. Nor does Walker teach or suggest the specific amounts of the difunctional and monofunctional reactive diluents. As discussed above the combination of difunctional and monofunctional reactive diluents and the specified amounts help to provide an infiltrant system having the desired properties.

Therefore, claims 11, 12, 50, 51, and 56 would not have been obvious to one having ordinary skill in the art at the time the invention was made over Walker in view of Chow.

The rejection of claims 34, 35, 53 and 54 under 35 U.S.C. § 103(a) as being unpatentable over Walker in view of Alvino and Chow has been overcome. As discussed above, Alvino and Chow fail to remedy the deficiencies of Walker.

With respect to claims 34 and 35, Walker does not teach or suggest the claimed mixed viscosity. Neither Alvino nor Chow remedies this deficiency. In addition, as to claim 35, Walker, Alvino, and Chow, alone or in any combination, do not teach or suggest the use of the combination of diglycidyl ether and glycidyl ether. Furthermore, Walker, Alvino, and Chow do not teach or suggest the claimed amounts of diglycidyl ether and glycidyl ether. As discussed above the combination of difunctional and monofunctional reactive diluents and the specified amounts help to provide an infiltrant system having the desired properties.

As to claims 53 and 54, Walker, Alvino, and Chow do not teach or suggest the use of a combination of diglycidyl ether and glycidyl ether. Furthermore, Walker, Alvino, and Chow, alone or in any combination, do not teach or suggest the claimed amounts of diglycidyl ether and glycidyl ether. Therefore, claims 34, 35, 53, and 54 would not have been obvious to one having ordinary skill in the art at the time the invention was made over Walker in view of Alvino and Chow.

CONCLUSION

Applicants respectfully submit that the application is now in condition for allowance.

If the Examiner has any questions or comments regarding the present application, he is invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,
DINSMORE & SHOHL LLP

By /Patricia L. Prior/
Patricia L. Prior
Registration No. 33,735

One Dayton Centre
One South Main Street, Suite 1300
Dayton, Ohio 45402-2023
Telephone: (937) 449-6400
Facsimile: (937) 449-6405

PLP/